#3100

# TECHNICAL MEMORANDUM
## Utah Coal Regulatory Program

March 30, 2009

TO: Internal File

THRU: Priscilla Burton, Team Lead PwB by SQS

FROM: David Darby, Environmental Scientist III

SUBJECT: Permit Application - Coal Hollow Project, Alton Coal Development, Coal Hollow Mine, C/025/0005, Task ID #3100

**SUMMARY:**

On March 14, the Division determined the Coal Hollow Permit Application Package to be Administratively Complete. Although all of the sections of the rules were addressed to some degree some technical deficiencies were identified. On January 24, 2008 Alton Coal Development (ACD) resubmitted an updated plan to permit review. Deficiencies were found. A response to deficiencies in the Coal Hollow Mine plan were received on December 22, 2008. This review assesses those deficiencies and addresses the issues of the presence of an alluvial valley floor and the affects mining will have on the regional and local hydrologic regime.

**Deficiencies:**

**R645-301-720**, The applicant uses the site number to identify the water right on Drawing 7-3. The Division will require monitoring of all water rights that have a potential be be impacted by mining in the event remediation needs to be conducted. Water rights need to be submitted in a table that identifies the water right, the sampling site number, the type of water right (use), the amount of the right, recorded flow, ownership and status.[DWD]

**R645-301-724.100,** Restated from Task 2910. The applicant needs to consolidate well information so it is more readily accessed. The applicant should develop a table to show all wells which are in the database, Tables in Appendix 7-1and show which ones are monitored, which ones have water rights, ownership, collar elevation, ground elevation depth to water from ground, elevation of water, which map they are located on and how they are monitored (for field and quality parameters, field parameters, elevation only). •The applicant stated; a new well information summary table (Table 10) was submitted with the new permit application. Table 10 could not be found.• The applicant needs to consolidate spring information so it is more readily accessed. The applicant should develop a

table to show all springs, which ones are monitored, which ones have water rights, ownership, flow range, which map they are located on and how they are monitored (for field and quality parameters, field parameters, flow only). •The applicant mentioned the spring information summary table (Table 11) was submitted with the new permit application. Table 11 could not be found. •The applicant will need to show the seasonal variation of ground water on a map for the entire permit area and adj acent area. •During the last review the Applicant was asked to show the seasonal variation of ground water on a map for the entire permit area and adjacent area. The applicant provided Figures 13 showing the average depths to groundwater relative to surface in the alluvial groundwater system in the proposed and adjacent permit area during 2007. Wells Y-102, Y-61 and Y-59 and C-5 showed artesian flow. Figure 14 is presented to show the seasonal variation in groundwater levels in the alluvial system during 2007. It is assumed that the values in Figure 14 represent the total change, but it is not the information the Division was requesting. The applicant needs to provide the seasonal variation as isohyatal lines for quarterly changes, as monitored represented by isopiestic lines. [DWD]

**R645-301-728.310**, Restated deficiency from Task 2910. The Applicant shall supply a series of cross-sections that depict the relationship between the mine pit and Sink Valley trough, and show the expected change to in the groundwater head as a result of mining. The detailed cross sections should illustrate the depth and distance (length) of open pit face that potentially intercepts the groundwater regime in Sink Valley, . Cross sections should be projected through the permit area and Sink Valley every 1,000 feet, or through the mine pits. All cross sections should show the expected levels where mining will intercept Sink Valley and depicted accurately on a horizontal and vertical scale. Cross-sections should depict the change in groundwater from east to west. Cross-sections should also be generated from data to show the change in groundwater from north to south. (The Division recognizes that the changes in groundwater interception will be dynamic as pits •The applicant should discuss how the pit will be reclaimed to restore the groundwater level in Sink Valley. The applicant submitted one cross-section in Drawing 7-6 showing the mine workings in Pit 15. The drawing shows the interception of the alluvial basin in Sink Valley, but does not show the draw down of groundwater during mining and the recovery after mining. (after pits are opened and closed.) An aerial view projecting groundwater draw down and recovery should also be presented. [DWD]

**R645-301-731.100 and R645-301–731.200,** The Applicant shall provide seasonal baseline water monitoring information for all water rights. [DWD]

**R645-301-745.120,** The Application must provide detailed cross sections showing the depth and distance (length) of open pit face that potentially intercepts ground water from Sink Valley, see also R645-301-728.310. [DWD]

**R645-302-320,** The Division finds the appearance of stream laid deposits in the center of Sink Valley. The applicant will have to show that the proposed operations will not interrupt discontinue or preclude farming on an alluvial valley floor, and that the groundwater system in Sink Valley can be restored. The Applicant was directed to show cross-sections on 500 ft. intervals as to how the mine would intercept the Sink Valley trough, see deficiency R645-301-624, -724 and deficiency R645-301-728.310. Only one cross-section was submitted. The applicant will have to provide specific information on cross-sections at least every 1,000 foot intervals. The Applicant should show exact elevation where the mine will contact the Sink Valley trough and calculate the amount of flow expected while the pit is open. A north-south cross-section showing the gradient of the trough should be submitted to show how flow migrating from north to south might be affected. [DWD]

## TECHNICAL ANALYSIS:

### GENERAL CONTENTS

### ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR 783., et. al.

### GENERAL

Regulatory Reference: 30 CFR 783.12; R645-301-411, -301-521, -301-721.

### Analysis:

An environmental description of the Coal Hollow Mine permit and surrounding area is provided in Section 721. Baseline information is presented in Section 724. The climatic conditions (App. 7-6), geology and hydrologic conditions (App. 7-1), groundwater and surface water resources, monitoring and evaluation (App. 7-4) document site conditions.

Water rights information is presented in App. 7-3 and shown on Dwg 7-3. There isone domestic water right (SP-7) on the eastern permit boundary.

In Section 724.700 the applicant refers to App. 7-4 for the 1988 Water Engineering and Technology, Inc., report titled "Geomorphological and Sedimentological Characteristics of Sink Valley, Kane County, Utah". The report is presented to substantiate the Applicant's claim that no continuous stream channels exist therefore no stream laden deposits are present, thus no alluvial valley floor. Supplemental Alluvial Valley Floor information is presented in App. 7-7.

The Probable Hydrologic Consequences PHC Determination is presented in Section 728 of the MRP.

**Findings:**

The applicant has addressed the minimum requirements of the Utah Coal Rules.

## CLIMATOLOGICAL RESOURCE INFORMATION

Regulatory Reference: 30 CFR 783.18; R645-301-724.

**Analysis:**

The applicant has provided sufficient information to address this section. Climatological information is summarized in Section 724.400. Appendix 7-6 provides temperature and precipitation data that has been routinely collected at the Alton, Utah weather station since 1928 and an automatic weather station that was installed at the proposed Coal Hollow Mine permit area in December 2005. The data is summarized in Table 7-3.

The site has an average annual precipitation of 16.38 inches per year (Section 724.411). Wind data since 2005 are plotted in wind rose diagrams showing the average velocity (6 mph) and predominate direction (from the northeast) (Fig. 4, App. 7-1). Temperatures have be measured and summarized in Table 7-3.

**Findings:**

The applicant has provided sufficient information to address the minimum requirements of this section.

## GEOLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR 784.22; R645-301-623, -301-724.

**Analysis:**

The Applicant compiled, evaluated and presented a description of the regional and local geology. The application contains updates to the plates depicting the geologic conditions within the proposed area. A Utah Geological Survey publication, Geologic map of Alton Quadrangle, Kane County, Utah (2001) by Terry L. Tilton is included in the MRP. The report provides a good description of the geology of Sink Valley and the adjacent hills where mining will take place. The publication contains maps and cross-sections showing the stratigraphy and structure of the area around the minesite.

Mining will take place in the Smirl coal seam. The coal zone sits at the top of the Dakota Formation and below the Tropic Shale. The Tropic shale is about 700 feet thick. The strata in the region of the mine dip toward the north and north-east from 1 to 5 degrees. In Sink Valley the lower layers of the Tropic Shale remain. It has been broken and tilted to form hills surrounding Sink Valley. The Tropic Shale consists of expansive gray and carbonaceous silty shale and claystone. Information obtained from drilling indicates that the lower 200 to 250 feet of the formation consists of fairly uniform soft, dark gray, silty shale or thinly bedded claystone with occasional thin lenses of siltstone and occasional layers of bentonite-like clay. Where streams flow on the Tropic shale, steep sided arroyos have been cut by erosion along main streams and lateral gullies. Sink Valley is filled with alluvial and colluvial material. These Quaternary deposits include pediment alluvium, landslide deposits, mass wasting debris, and alluvial fan deposits.

Appendix 7-4 contains a report by Water Engineering and Technology, Inc., (September 1988), which describes the geomorphology and sediment characteristics of Sink Valley.

Sink Valley is a broad, low area, where flowing (artesian) springs create wetlands or fens, in some areas of the valley. Plate 2 shows the surface drainages in the vicinity of Sink Valley and the proposed Coal Hollow Mine. Sink Valley Fault bisects the mine permit area from north to south. The Applicant estimates the offset of the fault is 10 to 30 feet, with the west side lower than the east side. Mining will come in contact with the fault. There is no connection between the fault and the hydrologic system. The Bald Knoll Fault runs north-south, it lies substantially east of the mine permit area and has no influence on the mine hydrology.

**Acid and Toxic Materials**

The information on acid and toxic forming materials is presented in Section 623.100 and 728.320. The applicant is required R645-301-624.220 and 624.230 to collect and analyze for the potential of acid and toxic forming materials in the geological strata above, below and in the coal seam. The information is required to assess the potential for contamination of surface and groundwater by the overburden removal.

The applicant conducted a drilling program to collect cuttings and cores in 2005. Sediment, bedrock and coal samples were collected from seven locations within the project area for analysis of acid and toxic forming potential. A drill hole location map and analytic information are provided in Appendix 6-2. Samples were analyzed for texture, pH, EC, SAR, % lime, water extractable boron, total metals (including selenium), and acid base accounting. High levels of iron (>5,000 ppm) are accompanied by high pH values (> 8.6) and high SAR values (> 35) in the overburden. The overburden is not rich in carbonates and presents limited neutralization potential, with some layers containing < 50 tons calcium carbonate per kiloton of overburden. The overburden having high SAR and/or pH will have to be selectively placed to minimize the potential of salt contamination, refer to deficiency written under R645-301-731.300.

The coal seam pH values range from 5.5 to 7. The coal will be removed from the pit and stored on the surface for a limited time before being sold. Runoff from the coal storage site will be controlled and treated.

The Division received several comments that suggested coal transported from the Coal Hollow mine site could contaminate the rivers and streams if it falls along the roadside, and then is washed into the streams. The Division will forward such comments to agencies that have jurisdiction, such as the Utah Department of Transportation and to the State Highway Patrol.

One commenter suggested that the PAP should include baseline hydrologic information for the distance from the coal mine to the loadout in Cedar City. Baseline information is collected for the "**adjacent area**" that might be adversely affected by "coal mining and reclamation operations" as defined in R645-100-200. For the purposes of geologic information, the baseline must include adequate information for an alluvial valley floor determination.

**Findings:**

The application does not meet the Geologic Resource Information requirements. See deficiencies written under alluvial valley floor.

## HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

**Analysis:**

**Sampling and Analysis**

The Applicant addresses sampling and analysis in Section 723 of the PAP. The applicant attests and commits to water quality sampling and analyses conducted according to the Standard Methods for the Examination of Water and Wastewater" or EPA methods listen in 40 CFR Parts 136 and 434.

**Baseline Information**

**Water Rights**

Water rights replacement is described in Section 731.800 of the PAP. The applicant provides some water rights information in Appendix 7-3 and identifies the locations on Drawing 7-3. The applicant uses the site number to identify the water right. The Division will require monitoring of all water rights that have a potential be impacted by mining. This baseline information will be consulted in the event remedial action is warranted. The applicant needs to provide information about the water rights to clarify that all water rights have been monitored. The applicant will be required to produce a table correlating the water right with the monitoring sites, and also include the type of water right, use, status, location and ownership, see deficiency written under R645-301-720.

Water rights need to be correlated with sampling sites to show all water rights have been or are being monitored. All water rights need to be associated with a monitoring site to establish a discharge or water level (quantity) and quality in the event it becomes impacted by mining operations.

**Ground Water**

The applicant has provided a baseline groundwater monitoring plan in Chapter 7, Section 724.100 and again in Appendix 7-1 in the Peterson Hydrologic Report (PHR). An Operation and Reclamation monitoring plan is provided in Section 730, which is based on the PHC.

The Applicant has conducted baseline monitoring for surface and ground water resources on and adjacent to the proposed mine. Table 7-1 presents the location, source and use of baseline monitoring stations. Table 7-5 shows the hydrologic monitoring locations for surface and groundwater sites, and assigns the protocols for monitoring parameters and frequencies. Table 7-4 defines the monitoring protocols. Table 7-6 identifies the list of field and laboratory parameters to be monitored quarterly at surface baseline sites. Table 7-7 identifies the list of field and laboratory parameters the to be monitored quarterly at groundwater baseline sites.

Spring and stream flow data and well level information from surveys conducted in 1987 and 1988 by Utah International have been provided. The applicant has also conducted sampling between the second quarter of 2005 through the 4th quarter 2008. Some of this data is submitted in Appendix 7-1, in a 2007 hydrologic report prepared by Petersen Hydrologic, LLC. Other data

has been submitted the Division's Water Quality Database. The Division conducted a review of the data.

The baseline monitoring locations identified in Table 7-1 presents the location source and use of baseline monitoring stations. Drawing 7-1 shows the locations of springs in the proposed Coal Hollow permit and adjacent area. The drawing does not show the location of wells as identified in 724.100 of the PAP. Table 7-5 shows the hydrologic monitoring locations for surface and groundwater sites, and it lists the protocols for monitoring parameters and frequencies identified in Table 7-4. Table 7-6B identifies the list of field and laboratory parameters the applicant proposed to monitor quarterly for surface baseline sites. Table 7-7A identifies the list of field and laboratory parameters the applicant proposed to monitor quarterly for groundwater baseline sites.

The manner in which the applicant presented baseline water monitoring information is a little confusing and takes some effort to locate all the monitoring sites and data. For instance, data for spring SP-27 has been submitted to the water monitoring database for the past three years. The SP-27 spring site is located on Drawing 7-1 but not on Figure 20 of the Peterson Report. Sorensen Spring is identified on Figure 20 of the Peterson Report, but not on any of the PAP drawings. All flow data for SP-27 report <0.1 gpm with a single measurement for specific conductance of 4,640 umhos/cm. A full laboratory analysis for SP-27 is also in the Peterson Hydrologic Report 2007.

The applicant needs to consolidate both spring and well information so it is consistent and more readily accessed. The applicant should develop a table to show all springs, which ones are monitored, which ones have water rights, ownership, flow range, which map they are located on and how they are monitored (i.e. field and quality parameters, field parameters, flow ).

Drawing 7-1 shows two clusters of springs in the vicinity of the mine permit area, and associated with the alluvial plain of Sink Valley Wash, one is located on the northwest corner of Section 29 (Discharge Area A, Drawing 7-4) and the other is located on the northwest corner of Section 32 (Discharge Area B). The data shows that most of the springs within the proposed permit boundary emit very low flows. In the northern cluster, Spring SP-16 flows about 1 gpm, whereas, springs SP-22, SP-23, SP-24, SP-25 and SP-26 flow less than 0.1gpm. Spring SP-36 is shown on Drawing 7-1, but has not been reported to the DOGM Water Quality Database. Spring SP-14 has a flow range between 3 to 8 gpm. Springs lying just east of the mine permit area (also part of the northern cluster and Discharge Area A) consist of Springs SP-17, SP-18, SP-19 and SP-21, which flow less than 0.1 gpm. Springs SP-20 flows between 5-10 gpm and Spring SP-8 flows between 10 to 20 gpm. Only SP-8 is identified on Plate 7-2, as a baseline water monitoring station in the northern cluster. The DOGM database shows Springs SP-8, SP-16 and SP-20 have been monitored for field and laboratory parameters, although Spring SP-20 has one sample showing laboratory parameter assessment. The other springs in the northern cluster have had field parameters assessed.

The Applicant addressed deficiency R645-301-731 by stating that springs SP-8, SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and Sorensen Spring (SP-40), as well as, Springs SP-6, SP-8 and SP-33, located in Sink Valley below the proposed mine area, will be monitored for discharge and water quality during operational phase

Water quality in the northern cluster of springs is good. The pH ranges between 7 and 8. Conductivity is runs less than 800 umhos/cm in most samples, only Springs SP-24, SP-25 and SP-26 have conductivities in the 1,000 to 1,300 umhos/cm, which is still considered good. Heavy metal concentrations are very low. Calcium and magnesium constituents are a bit elevated.

Spring SP-6 is a low flowing alluvial spring located just outside the southern boundary of the mine permit area. SP-6 is not on Drawing 7-1, but is on Drawing 7-2. It has been monitored during several quarters during 2005, 2006 and 2007. Water quality analysis were collected and analyzed during the last three years. The water quality of SP-6 is similar to the water quality of the northern cluster springs.

The southern cluster of springs lies just south of SP-6. Springs SP-27, SP-28, SP-29 SP-30, SP-32, and SP-33. Spring SP-33 is the only spring in the cluster to be monitored for water quality and field parameters. Quarterly reporting of field and laboratory parameters was submitted to the DOGM database for the past three years for SP-33 The other springs in the cluster were monitored for field parameters. All of the springs in the cluster except Spring-33 have very low flows, which range less than 0.1 gpm. Spring 33 flows between 4 and 13 gpm. Compared to the northern cluster of springs, the springs in the southern cluster have higher pH values (from 7.35 to 9.1), accompanied by higher levels of total dissolved solids and specific conductance, reflecting the higher levels of sodium, potassium and calcium the water has picked up as it migrates down the valley. The levels of heavy metals do not increase substantially.

**Wells**

The applicant discusses the use of wells to assess groundwater conditions in Section 724.100. The Applicant initiated a drilling program in the second quarter of 2005, which included 30 monitoring wells on and adjacent to the permit area. Investigative methods and results of the analysis of the data are described in Appendix 7-1. The information Table 7-4 gives a list of baseline monitoring wells, Y-36, Y-38 Y-45, Y-59, Y-61, Y-63, Y-99(A2), and Y-102(A5).

Drawing 7-12 shows the well locations for coal monitoring (boreholes) and alluvial monitoring wells. Drawing 7-13 shows the potentiometric levels of groundwater from water levels in the wells. Table 7-2 provides the monitoring well details (collar elevation, depth, depth

to bedrock and screened interval. It is unclear in the table if the depth is from the top of the collar or surface, see deficiency written under R645-301-724.100.

The applicant provides graphs of water elevations in wells Y-36, Y-38, Y-59, Y-63, Y-98 and Y-102. There is not a graph for Y-61, however there is some discharge data in the DOGM database. The data shows Y-61 is an artesian well

The well monitoring data has provided the applicant with the information to evaluate the groundwater regime. Drilling programs identified the depth of coal, identify overlying strata and establish the level of groundwater or piezometric surface of groundwater, Drawing 7-13. Table 10, Appendix 1 identifies two wells as having artesian flow in Sink Valley, Y-61 and C5-130, in alluvial ground water system east of the permit area (Dwg. 7-12 and 7-13, Table 1 and Table 5 in Appendix 7-1). Assessment of data from wells Y-61 and Y-102 indicates groundwater quality in Sink Valley is of good quality and plentiful. The seasonal variation of water quality is established for these two sites. These reflect the groundwater moving through Sink Valley from Water Canyon, Section 21 drainage, and Swapp Canyon drainage. The applicant conducted a drawdown and recovery test on Well Y-61. The pumping rate was 334 gpm. Both springs (SP-20, SP-8, SP-14) and wells (C2-40, C3-40, C4-30 and SS-30) were monitored for drawdown. Figures 17 and 18 in show graphs over the elapsed time of pumping.

Mining in the lower part of Section 30 will also destroy wells Y-102, C2, C7, C8, and C9, which lie within the Sink Valley groundwater trough. Groundwater monitoring should be established in the lower part of sink valley to monitor water quality changes during operational and reclamation phases.

Holes have been drilled on the west side of the drainage divide LR, LR45 CO, C6, Y49 and Y50. Well C6 was dry during four quarters in 2007. Wells CO, Y49, Y50 were monitored, but no seasonal water quality was collected. Water level data has been provided for several boreholes during the quarters of 2007 and first quarter of 2008. There is very little water quality data from wells on the Robinson Creek side of the drainage divide Figure 19, Appendix 7-1. Alluvial sediments are shallower in the Robinson side of the permit and the well information shows lower water levels. Mining in this area will destroy most of the wells.

Although there is only a small amount of monitoring information on the west side of the permit area, the applicant has established the hydrologic regime in that part of the permit area Figures 21 and Drawing 7-13. The groundwater drainage divide created by the fault and dip of the beds have isolated the west and northern portion of the mine permit from the recharge areas to the west.

The piezometric surface was derived with a paucity of well data on the west and north side of the permit. The method used to derive the piezometric surface must be described.

The Applicant has pointed out that water is appreciable in the Tropic Shale and therefore does not offer the characteristics of an aquifer. There is no discharge to springs and no water supply wells in the Tropic Shale. The same is true for the Dakota Sandstone.

During the last review tha Applicant was asked to show the seasonal variation of ground water on a map for the entire permit area and adjacent area. The applicant provided Figures 13 showing the average depths to groundwater reletive to surface in the alluvialo groundwater system in the proposed and adjacent permit area during 2007. Wells Y-102, Y-61 and Y-59 and C-5 showed artesian flow. Figure 14 is presented to show the seasonal variation in groundwater levels in in the alluvial system during 2007. It is assumed that the values in Figure 14 represent the total change, but it is not the information the Division was requesting. The applicant needs to provide the seasonal variation as isohyatal lines for quarterly changes, as monitored represented by isopiestic lines.

When no longer needed for monitoring or other use and upon a finding of no adverse environmental, health or safety effects, or unless approved for transfer as a water well under R645-301-731through 731.522 and 731.800 each well will be capped, sealed and backfilled, as required by 631.100 and 748.

No wells with water rights are shown in Drawing 7-3. The applicant needs to consolidate well information so it is more readily accessed. The applicant should develop a table to show all wells which are in the database, Tables in Appendix 7-1and show which ones are monitored, which ones have water rights, ownership, collar elevation, ground elevation depth to water from ground, elevation of water, which map they are located on and how they are monitored (for field and quality parameters, field parameters, elevation only).

**Probable Hydrologic Consequences Determination**

The probable hydrologic consequences Determination is presented in Section 728. The potential adverse impacts are identified. The applicant contends that other than short term diminution of discharge rates to some springs and seeps in in Sink Valley no adverse impacts will take place on or off the mine site. It is not expected that appreciable amounts of groundwater will be encountered in the Tropic Shale area as a result of the heterogeneity of the rock strata, which impedes flow. Similarily, impacts will not occur to groundwater resources in to Dakota Formation. The Navajo Sandstone is the first major aquifer below the Smirl Coal seam. It lies about 1000 feet below the coal seam and should not be influenced by mining.

The Applicant provides Plate 2 and Figure 19 (App. 7-1) showing the surface water drainages. Three major drainages appear in the vicinity of the mine: The upper Kanab Creek Drainage, the Sink Valley Drainage and Johnson Wash Drainage. Lower Robinson Creek Sub Drainage, Dry fork Sub Drainage Runoff from Water Canyon, Dry Fork and Lower Robinson Creek drain across the northwest side of the mine permit area. Section 21 Canyon and Swapp

Hollow are the recharge source for Sink Valley. The bulk of the groundwater fluxes through the area on the eastern side of the mine. Sink Valley is made up of course grained alluvial and coalluvial sediments that transmit the groundwater. Maps of the Sink Valley Drainage, as shown in Figure 21, Appendix 7-1 Drawing 7-4 shows two major locations of alluvial groundwater discharge areas east and southeast of the mine permit area. Figure 7-13 shows the potentiometric level of groundwater in the alluvial/Sink Valley area. In this same map the applicant shows the approximate location of the alluvial groundwater divide between Sink Valley and Lower Robinson Creek drainage.

The coal recovery area is shown on Drawing 5-14. The recovery area follows the approximate location of the fault on the east side of the permit. The drawing shows the coal thickness ranges from 7 feet to the west to 18 feet on the east side of the permit area. Overburden thickness in the coal recovery area ranges from zero the about 200 feet on the east side of the permit boundary near the fault. Most of the coal in the recovery area lies below 140 feet. Drawing 5-16 shows the sequence of mining and extent of the surface disturbance from mine pit development. Plate 5-12 shows the typical cross-section of the mine pit.

The Division received comments that groundwater will be depleted and contaminated when mining takes place. The Division has evaluated the PAP for potential impacts mining will have on the groundwater systems of Lower Robinson Creek and Sink Valley wash.

The first year of mine development will take place in the Robinson Creek drainage. It is expected that the mine will encounter only minor amounts of ground water in the coalluvial deposits above the permit area and groundwater trapped in the coal zone. The second and third years will see Pit 2 and Pit 3 developed in the eastern part of the permit. As the mine progresses westward the bottom of the pit will not extend all the way to the permit boundary, but stop at a point where the pit walls, angled at about a 2:1 slope, will extend from the pit floor to the permit boundary. When the pit walls are excavated on the east, mining will mine through the west side of the alluvial trough (Petersen Hydrologic Report Figures 6d, 6e, and 6f Petersen report). This alluvial trough holds and channels groundwater from the drainages to the lower basin of Sink Valley. These cross-sections should be extended westward to include the mine pit, such that an idea of the elevation of the cut and the lowering of the gradient of the groundwater in Sink Valley could be ascertained. The Applicant must supply cross-sections, that depict the mine pit, and Sink Valley trough, and show the expected change to the groundwater head as a result of mining. The Applicant should discuss how the pit will be reclaimed to restore the groundwater level in Sink Valley.

The information supplied indicates the Sink Valley aquifer may be drawn down substantially. As an example, if one looks at cross-secton D-D' in Figure 6e, Petersen Hydrologic Report, December 15, 2008) and imposes the mine pit in relation to the cross-section. The mine pit is expected to be about 110 feet in the area of Well C-3, Drawing 5-15. The mine pit wall angle is about a 2:1 slope, Drawing 5-12. That puts the bottom of the pit 220

feet from the mine permit boundary. As mining removes the western edge of the trough that holds the aquifer, flow from the aquifer will enter the mine. Rough estimates near Well C-3 show the aquifer could be lowered 30 feet, which equates to a large volume of water. When one considers that the Sink Valley aquifer will be mined into almost a mile, groundwater interception could be substantial if the replacement material does not seal the aquifer.

The recharge source from the east works in favor of still supplying the aquifer. The Division suggests the applicant consider installing wells along the east side of the permit area and pump groundwater back to Sink Valley, to the channel where some flows can be used. It will eliminate flow to the pit where it can become more contaminated. It will also eliminate pumping to Kanab Creek via Robinson Creek.

**Findings:**

The Division analyzed surface and groundwater data from the database and PAP to determine whether sufficient monitoring information was available to assess the hydrologic regimes, establish seasonal variation, and the potential adverse impacts to the hydrologic balance for the PHC, the Division does not find the data sufficient, see deficiencies written below.

The Applicant has not submitted sufficient information to show the hydrologic balance will be maintained. Geologic information identifies a hydrologic barrier between the Sink Valley aquifer and the proposed mine pit. Information presented in the Petersen Hydrologic Report Figures 6d, 6e, and 6f shows the level of groundwater at different monitoring sites in Sink Valley. Mining of the pit will remove some of the barrier that contains the groundwater in Sink Valley. Extending the cross-sections westward to include the mine pit will allow the reviewer to see the reduction of the hydrologic barrier and potential change of the groundwater level.

**R645-301-720**, The applicant uses the site number to identify the water right on Drawing 7-3. The Division will require monitoring of all water rights that have a potential be be impacted by mining in the event remediation needs to be conducted The applicant needs to provide information about the water rights to clarify that all water rights have been monitored. The applcant will be required to produce a table correlating the water right with the monitoring sites, and also include the type of water right, use, status, location and ownership. [DWD]

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**R645-301-724.100,** The applicant needs to consolidate both spring information so it is more readily accessed. The applicant should develop a table to show all springs, which ones are monitored, which ones have water rights, ownership, flow range, which map they are located on and how they are monitored (for field and quality parameters, field parameters, flow only). The applicant stated; the a spring information summary table (Table 11) was submitted with the new permit application. Table 11 could not be found. [DWD]

**R645-301-724.100,** The applicant will need to show the seasonal variation of ground water on a map for the entire permit area and adj acent area. During the last review the Applicant was asked to show the seasonal variation of ground water on a map for the entire permit area and adjacent area. The applicant provided Figures 13 showing the average depths to groundwater reletive to surface in the alluvial groundwater system in the proposed and adjacent permit area during 2007. Wells Y-102, Y-61 and Y-59 and C-5 showed artesian flow. Figure 14 is presented to show the seasonal variation in groundwater levels in in the alluvial system during 2007. It is assumed that the values in Figure 14 represent the total change, but it is not the information the Division was requesting. The applicant needs to provide the seasonal variation as isohyatal lines for quarterly changes, as monitored represented by isopiestic lines. [DWD]

**R645-301-728.310,** The applicant shall supply cross-sections that depict the relationship between the mine pit and Sink Valley trough, and show the expected change to in the groundwater head as a result of mining. The applicant should discuss how the pit will be reclaimed to restore the groundwater level in Sink Valley. The applicant submitted one cross-section in Drawing 7-6 showing the mine workings in Pit 15. The drawing shows the interception of the alluvial basin in Sink Valley, but does nothing to show the draw down of groundwater during mining and the recovery after mining. Cross section should be projected through the permit area and Sink Valley every 1,000 feet, or through the mine pits. All cross sections should show the expected levels where mining will intercept Sink Valley and depicted accurately on a horizontal and vertical scale. Cross-sections should depict the change in groundwater from east to west. Cross-sections should also be generated from data to show the change in groundwater from north to south. It is realized that the changes in groundwater interception will be dynamic as pits are opened and closed. An aerial view projecting groundwater draw down and recovery should also be presented. [DWD]

## OPERATION PLAN

## HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

### Analysis:

#### General

Figure 19 (App. 7-1) illustrates the groundwater recharge areas of Sink Valley. The minesite is divided into two drainages. Runoff from Dry Fork and Lower Robinson Creek drain across the northwest side of the mine permit area, while Section 21 Canyon and Swapp Hollow supply flow to the Sink Valley drainage.

An evaluation of the PAP identifies a potential for groundwater interception along the eastern edge of the proposed mine permit that could have a substantial influence on the function of the ground water system in Sink Valley. Potentiometric surface levels in Drawing 7-13, the groundwater cross-sections associated with Figure 6-a in the Peterson Report as well as Figure 16, cross-sections in Figures 6, 7 and 8, the flow pattern in Sink Valley Wash shown in Figure 21, the alluvial groundwater discharge area in Figure 16, and the drawdown and recovery data shown in Figures 17 and 18, all paint a picture of the groundwater resources on and adjacent to the minesite.

Most of the groundwater activity lies east of the fault the lies on the east side for the mine permit area. The fault is not the controlling factor in groundwater movement. It is only linked to groundwater conditions in as much as it offsets the strata some 10 to 30 feet higher on the east than the west. The offset in combination with the regional dip of the strata create a trough of Sink Valley. It is likely that Pliestocene runoff helped deepen the trough of Sink Valley that later filled with Quaternary material for form the present valley.

#### Groundwater Monitoring Plan

The applicant plans to continue monitoring springs and wells throughout the mining and reclamation operation mining operations. Drawing 7-1 shows locations for seeps and springs.

Section 731.200 provides a groundwater monitoring plan that describes the baseline monitoring activities as shown in Table 7-1. At the end of the hydrology section is a list of baseline monitoring sites for springs, streams, wells and alluvial trenchs. Table 7-2 identifies details of monitoring wells, which include the well number, date drilled, screened formation,

collar elevation, depth of well, depth of bedrock, and screened interval. Table 7-4 identifies the monitoring protocols for the monitoring sites. Table 7-5 also provides a list of monitoring sites and gives a brief description of their location. Tables 7-7a and 7-7b identify the water quality parameters the applicant has proposed to monitor for groundwater operational and baseline conditions.

The applicant presents some water quality data collected by Utah International during 1987 and 1988, for their mine application. The applicant began monitoring baseline groundwater conditions in mid to late 2005and continues today. Data has been sent to the DOGM Water Quality Database. Some of the same data is presented in the Petersen Hydrologic Report in Appendix 7-1. The Division has produced tables from the database, which reflect the accumulation of surface and groundwater data through the first quarter of 2008.

**Springs**

The applicant has monitored springs for field parameters and water quality. Springs SP-3, SP-4, SP-5, SP-6, SP-8 and SP-33, Johnson Spring, are identified on the baseline monitoring map, Dwg 7-2. The database shows five springs (SP-3, SP-4, SP-6, SP-8 and SP-33, Johnson Spring) were monitored for field parameters and water quality from mid 2005 to the first quarter 2008. Springs SP-3 and SP-4 were not originally proposed as full-suite water quality monitoring sites, p7-45. Several other springs are monitored for discharge and field parameters. Table 7-5 shows SP-3 is to be monitored for quality, but SP-4 is to be monitored only for field parameters.

The text identifies eight springs in the alluvial system that will be monitored for groundwater, (SP-8, SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and SP-40 (Sorensen Spring). SP-8 will be monitored quarterly for discharge and operational laboratory water quality. Springs SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and Sorensen Spring will be monitored for discharge and field water quality measurements. SP-15, SP-17, SP-18, SP-21, SP-23, SP-25, SP-26, SP-27, SP-28, SP-29, SP-30, SP-31, SP-34, SP-35, SP-36 and SP-37 are identified as monitoring springs in Table 7-1, but are not shown on Dwg 7-2 or discussed in the text. Spring 23 is listed in Table 7-5 as a monitoring site, where field and quality parameters should be collected. The Applicant should insure all tables and text correlate to each other. The tables at the end of Section 7 are the same as a set of tables in Appendix 7-1, Petersen Hydrologic, LLC report. The drawings in the Petersen Report show different water monitoring locations than the drawings in the text. The applicant should make sure all groundwater monitoring sites are located on the groundwater monitoring map and their protocols are represented on the map and legend. The text, maps (including legend) and tables, all need to be consistent and correlate with each other.

**Wells**

The applicant identifies a monitoring plan for wells in Section 731.200. Wells Y-61, LS-85, SS-30, UR-70 andLR-45 will be monitored quarterly for groundwater operational laboratory

water quality parameters, which is Table 7-7A. Wells Y-98, Y-45, Y-102, Y-36, Y-38, C5-130, C2-15, C2-28, C2-40, C3-15, C3-30, C3-40, C4-50, C7-20, C9-25, C9-40, LS-28, LS-60, LS-85, SS-15, SS-30, SS-75 CO-18 and CO-54 will be monitored quarterly for water level. Of these springs Y-98, Y-99, Y-102, Y-36, Y-61, Y-59, Y-45, Y-38 and Y-63 are identified on the monitoring map, Drawing 7-2. Drawing 7-11 shows the typical design of a monitoring well.

**Findings:**

The information provided does not meet the requirements of the hydrologic monitoring rules. Prior to approval, please provide the following information, in accordance with:

**R645-301-731.100,** The Applicant shall provide seasonal baseline water monitoring information for all wells with water rights. [DWD]

**R645-301-731.200,** The Applicant shall provide seasonal baseline water monitoring information for all springs with water rights.[DWD]

# RECLAMATION PLAN

## HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

**Analysis:**

**Hydrologic Reclamation Plan**

The Applicant submits that the geology restricts the flow of groundwater to the west. The same structure that directs and keeps groundwater in the Sink Valley trough limits its flow westward. Wells (piezometers) drilled in the north and western part of the permit area are said to have very little groundwater in the colluvial gravels. Whereas, wells and piezometers in the eastern and southern areas show higher potentiometric surfaces. The same is true in Sink Valley lying east of the permit area.

The Applicant identifies that there is a good potential of intercepting groundwater as mining moves east. The applicant has discussed mitigation plans in the form of a grout curtain to stem the flow of groundwater to the pit. The applicant states in Section 724.500, if substantial groundwater inflows into the mining areas as mining progresses to alluvial springs and seeps in

the eastern part of the permit area (Sink Valley), the conditions will be evaluated at the time they occur. The Applicant does not anticipate encountering a large volume of water.

It appears to the Division that there is a good potential for the mine to intercept groundwater at a high rate as the mine develops east and the walls of the mine pit are cut into the Sink Valley containment structure, (see Figure 8 A-A', Petersen Hydrologic report, June 12, 2007 and Petersen Hydrologic Report, Figure 6a, January 15, 2008). The applicant discusses using ground water resources secured from the town of Alton from water right 85- 744 for in mine use. This information was checked in the Utah Water Rights database. The town of Alton has ground water rights in Sink Valley for agricultural and municipal purposes. Alton Coal Development has purchased the use of 50 acre-feet per year and has an option to purchase more as necessary. The mine can use the water for development or temporary mitigation in the event state appropriated water is intercepted

The Applicant has not provided the basic details of surface contact with the Sink Valley aquifer, specifically the elevations of the mine contact with the alluvium of Sink Valley,

**Findings:**

The information provided does not meet the requirements for hydrologic reclamation and mititgation described in the Coal Rules.

**R645-301-745.120,** The Application must provide detailed cross sections showing the amount of open face that potentially intercepts ground water from Sink Valley. [DWD]

## ALLUVIAL VALLEY FLOORS

Regulatory Reference: 30 CFR 785.19; 30 CFR 822; R645-302-320.

**Analysis:**

**Alluvial Valley Floor Determination**

The applicant has provides a very good argument that the material that fills the Sink Valley floor is a coalluvium instead of stream laid deposits identified in the requirements of the definition of alluvial valley floor. The applicant provides a report "Geomorphological and Sedimentological Charasteristics of Sink Valley, Kane County, Utah" by Water Engineering and Technilogy (WET), Inc., 1988 argues that the sediment in Sink Valley is of course material in an alluvial fan laid down by unconfined sheet floods, debris flows and mud flows. The report

claims there was never a continuous stream in Sink Valley. Thus, the definition that defines an alluvial valley floor in Sink Valley is not met.

During the 1988 mine permit application an Alluvial Valley floor determination was made that concluded there were AVF's in Sink Vally and along Kanab Creek . An evaluation by the current DOGM staff finds there are features in Sink Valley that indicate an AVF in the center of the valley.

The applicant addresses the potential for AVF in lower Sink Valley and Kanab Creek. The areas are shown on Plate 5. This reviewer made a negative finding of an AVF for Kanab Creek, because the water used to supply crops is diverted upstream and piped to the crops.

Figure 19 shows the tributaries to Sink Valley. The figure and several maps show a stream channel in Sink Valley. Sink Valley has the appearance of an alluvial valley floor, because it once contained a continuous stream channel, which deposited alluvial stream laden sediments. There are undoubtedly both coalluvial and stream laid deposits Sink Valley from past geomorphic activity. After reviewing the information in the PAP and the WET report the Division concludes it's likely that both alluvial and coalluvial systems operated to form large alluvial fans along the edge in Sink Valley. In the middle and below Swapp Hollow the streams running from the fan combine to form an alluvial channel down Sink Valley. The stream flow that enter the valley in the early spring is now captured and dispersed along the valley via ponds and diversions. Maps including Plate 2, shows the surface water drainage patterns, and Drawing 7-7 shows stream patterns. The aerial photograph of Plate 4 shows the surface features in Sink Valley, including the alluvial fan at the upper end of the valley. Most of the main channel has been covered in the past by farming activity, leaving a series of ponds that outline the channel. If the streamflow to the valley was significant the channel would most likely have been left intact. Some of the runoff from Water Canyon is diverted to Robinson Creek while the rest of the water including that from Section 21 Canyon infiltrates into the alluvial fan at the upper end of Sink Valley. It is believed that the finer alluvial that has built up in the middle of Sink Valley as it filled with sediment material retards the groundwater flow in the eastern and western sides of the valley.

There is farming adjacent to the stream. The crops are watered with spring runoff and direct precipitation. One crop is harvested annually unless precipitation allows a second crop of grass hay to be harvested. Most subirrigation and agricultural activity occurs on the edges of Sink Valley where groundwater flows through coalluvial deposits from the adjacent hillsides. By definition these conditions do not constitute an AVF. The Applicant plans to mine in the vicinity of the springs and groundwater resource flowing through the coalluvium. The Applicant has been directed to submit water rights data to identify any spring and well with state appropriated waters that may have to be replaced.

The ground water supply from Robinson, Water, Section 21 Canons and Swapp Hollow recharge the springs in Sink Valley as well as the deep groundwater system and alluvial stream laid deposits. As mentioned the stream laid deposits are less porous and have less transmissivity than the coalluvial deposits. From the WET Report it is interpreted that the stream laid deposits range along the eastern to middle part of Sink Valley beginning below Swapp Hollow to the lower canyon of Sink Valley.

The stream laid deposits will not be mined, however some of the ground water comes from the coalluvial sediments. Any interruption of the coalluvial sediments might lessen flow to the alluvial sediments, however the amount of this flow is unknown. Recharge to the alluvial sediments could also come from the deeper ground water and alluvial fans in Swapp Hollow. During the field visit in October, by DOGM personnel, the flow could be seen as very small trickles into the ponds in the channel. The ponds retained only small amounts of static water. It appeared that the inflows were equal to evapotranspiration and infiltration. There appears to be no springs in the alluvial sediments, however there are surface water rights along Sink Valley (Drawing 7-3). The Applicant has already established a water monitoring plan for the streams and has committed to replacing any water rights that are interrupted. Water monitoring site SW-8 is on Swapp Hollow creek and SW-9 is located at the lower end of Sink Valley. Surface runoff is typical of a semi-arid desert. Site SW-9 is dry most of the time with an occasional large flood (763 gpm, 02/16/88). Other flows range from 1.3 gpm to 18 gpm.

As mining progresses to the east it first encounters a ridge of Tropic Shale. The ridge is a mass of consolidated non-permeable rock forming the west limb of the Sink Valley trough. As mining encounters and removes the limb, it will come in contact with the coalluvial sediments that transport ground water to the springs. Many of the springs, which receive their supply of groundwater through the alluvial system are likely to be impacted, because the supply will be severed. The supply can be reestablished after the coal is extracted if the mine pits are reconstructed properly, so that the fill that once formed the limb of the trough is reformed and tightly compacted. The spring flow can be reestablished if coalluvial sediments are backfilled. Springs may not reestablish in exactly the same place, but the supply source coming from the north east will continue to deliver flows to the area.

The applicant has addressed some issues stating that mining will take place in pits that will be open no more than 120 days (Sections 724.500 and 728.310, p. 7-31). The applicant stated that if substantial ground water flowed into the mine a study would be conducted to mitigate the flow. The Applicant was directed to show cross-sections how the mine would intercept the Sink Valley trough. Only one cross-section was submitted. The applicant will have to provide specific information on cross-sections at least every 1000 foot intervals. The Applicant should show exact elevation where the mine will contact the Sink Valley trough and calculate the amount of flow expected while the pit is open. A north-south cross-secton showing the gradient of the trough should be submitted to show how flow migrating from north to south might be affected.

**Findings:**

**R645-302-320,** The Division finds the appearance of stream laid deposits in the center of Sink Valley. The applicant will have to show that the proposed operations will not interrupt discontinue or preclude farming on an alluvial valley floor, and that the groundwater system in Sink Valley can be restored. The Applicant was directed to show cross-sections on 500 ft. intervals as to how the mine would intercept the Sink Valley trough, see deficiency R645-301-624, -724 and deficiency R645-301-728.310. Only one cross-section was submitted. The applicant will have to provide specific information on cross-sections at least every 1000 foot intervals. The Applicant should show exact elevation where the mine will contact the Sink Valley trough and calculate the amount of flow expected while the pit is open. A north-south cross-secton showing the gradient of the trough should be submitted to show how flow migrating from north to south might be affected. [DWD]

**RECOMMENDATIONS:**

This application is not recommended for approval.

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